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ANOMALOUS EM SIGNALS AND CHANGES IN ELECTRICAL RESISTIVITY AT PARKFIELD: COLLABORATIVE RESEARCH BETWEEN THE UNIVERSITIES OF CALIFORNIA AT BERKELEY AND RIVERSIDE AND OREGON STATE UNIVERSITY

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Abstract

This project is part of a search for possible electromagnetic (EM) earthquake precursors on the San Andreas Fault near Parkfield and Hollister, California. There have been a number of reports of anomalous EM signals preceding large earthquakes, and it has been suggested that such signals could be useful predictors of seismic activity. However most observations of EM precursors have been fortuitous, and difficult to verify. This project aims at more systematic monitoring, so that any possible precursors in the Parkfield area would be observed under more controlled circumstances. The work at Oregon State University supports field efforts, with a focus on development and application of data processing methods. Our goal is to remove ionospheric and cultural EM noise, thus improving chances of detecting and better understanding the nature of any EM signals originating in the earth that might be associated with earthquakes. During this project period the focus of our efforts has been on development of a streamlined and user friendly data processing system. The system is now being used is for data quality control, with routine processing done automatically once per day. A warning is emailed to responsible scientists and technicians whenever estimated signal-to-noise ratios fall below a critical level. The processing system also includes features for sophisticated multivariate processing, time domain residual analysis, and interactive display and editing of spectral statistics and time series. Initial steps have also been taken to include data from the UC Riverside long baseline dipoles in the multivariate analysis.

Non-Technical Summary:

There have been a number of reports of anomalous electromagnetic (EM) signals preceding large earthquakes. If these reports could be verified, monitoring of such signals could improve prediction of potentially damaging earthquakes. However, most previous observations of EM precursors have been fortuitous, and difficult to verify. This project aims at more systematic monitoring of the area around Parkfield, California, where a number of other geophysical variables are monitored continuously. With signals observed under more controlled circumstances, it will be possible to verify their relationship to earthquake activity. A major complication with this search for anomalous EM signals, is that there is a continuous background of signals from other sources, including natural EM signals originating in the upper atmosphere and from lightning, and EM signals resulting from the activities of man. For example, the Bay Area Rapid Transit System (BART; a large scale DC electric railway in the San Francisco Bay area) produces EM signals that can be seen as far as 300 km away in Parkfield. The work at Oregon State University supports field efforts, with a focus on development and application of data processing methods to filter out natural and cultural EM noise, thus improving chances of detecting and better understanding the nature of any EM signals associated with earthquakes. A major part of our effort in this project has been to develop automated data processing schemes for data quality control and rapid routine processing.